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49455	7590	10/24/2005	EXAMINER	
STEIN, MCEWEN & BUI, LLP 1400 EYE STREET, NW SUITE 300 WASHINGTON, DC 20005			ALEJANDRO, RAYMOND	
			ART UNIT	PAPER NUMBER
			1745	

DATE MAILED: 10/24/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/072,907

Applicant(s)

CHOI ET AL.

Examiner

Raymond Alejandro

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 04 October 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-17 and 29-39 is/are pending in the application.
- 4a) Of the above claim(s) 29-37 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-17, 38 and 39 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 02/12/02 & 07/27/05 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- 1) ☒ Certified copies of the priority documents have been received.
 - 2) ☐ Certified copies of the priority documents have been received in Application No. _____.
 - 3) ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 10/04/05 has been entered.

This is in response to the amendment filed in conjunction with the foregoing RCE. The applicants have only overcome one of the 35 USC 112 rejections. Refer to the abovementioned amendment for substance of applicant's rebuttal arguments. However, the present claims are again rejected over the same art as seen hereinbelow:

Election/Restrictions

1. This application still contains claims 29-37 drawn to an invention nonelected with traverse in the reply filed on 01/06/04. A complete reply to this rejection must include cancelation of nonelected claims or other appropriate action.

Specification

2. The amendment filed 10/04/05 does not introduces new matter into the disclosure. See item # 6 below.

3. The amendment filed 04/06/05 is objected to under 35 U.S.C. 132 because it introduces new matter into the disclosure. 35 U.S.C. 132 states that no amendment shall introduce new

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matter into the disclosure of the invention. The added material which is not supported by the original disclosure is as follows: (claim 2) the recitation “*is greater than substantially 5 μm and is less than 10 μm* ” (which is mathematically equivalent to $5 \mu\text{m} < \text{pore size} < 10 \mu\text{m}$). Applicant has not pointed out where the new or amended claim is supported, nor does there appear to be a written description of the claim limitation “*greater than substantially 5 μm and less than 10 μm* ” in the application as filed. That is to say, the newly claimed subject matter is not adequately described in the original disclosure. Paragraphs 0022 and 0041 of the specification simply state that “Active pores....have an average size of up to 20 μm . Preferably, the average size is up to 10 μm , and more preferably up to 5 μm ”. Thus, such recitation is unsupported by the original disclosure. Applicant is required to cancel the new matter in the reply to this Office Action.

Applicant's arguments concerning the abovementioned new matter issue has been considered but they are not convincing as applicant has neither demonstrated nor provided evidence as to how it was arrived at the specific range of “greater than substantially 5 μm and is less than 10 μm ” (which is mathematically equivalent to $5 \mu\text{m} < \text{pore size} < 10 \mu\text{m}$)”.

Applicant's disclosure only supports main base values such as specifically “up to 20 μm ; Preferably, the average size is up to 10 μm , and more preferably up to 5 μm ”. Other than that, there is no existence in the specification as filed of other specific magnitudes (e.g. 6 μm , 7 μm , 8 μm , 9 μm , 11 μm , 12 μm and so on) investigated or studied by the applicants to evidently support applicant's position that such magnitudes of “less than 10 μm , not inclusive” were or are originally intended by the current disclosure. Therefore, other than attempting to overcome the prior art of record disclosing a pore size of “at least 10 μm ”, it is not clear how applicant has arrived at the specific now claimed magnitude. Yet further, the position taken by the applicant

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that "the bounds of the amended range needs to be at least mathematically between the more broadly disclosed bounded range since all amounts within the broad bounded range are necessarily disclosed" is not convincing in this instance because of the foregoing.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

5. Claim 2 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The added material which is not supported by the original disclosure is as follows: (claim 2) the recitation "*is greater than substantially 5 μ m and is less than 10 μ m*" (*which is mathematically equivalent to $5 \mu\text{m} < \text{pore size} < 10 \mu\text{m}$*). Applicant has not pointed out where the new or amended claim is supported, nor does there appear to be a written description of the claim limitation "*greater than substantially 5 μ m and less than 10 μ m*" in the application as filed. That is to say, the newly claimed subject matter is not adequately described in the original disclosure. Paragraphs 0022 and 0041 of the specification simply state that "*Active pores....have an average size of up to 20 μ m. Preferably, the average size is up to 10 μ m, and more preferably up to 5 μ m*". Thus, such recitation is unsupported by the original disclosure. Applicant is required to cancel the new matter in the reply to this Office Action. See also item 3 above.

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6. With respect to the 35 USC 112 regarding the scope of enablement (*item 4 in the final action dated 05/04/05*), applicant's arguments and amendments to the specification has been carefully considered and they have satisfactorily resolved the scope of enablement issue. Indeed, after examining applicant's original disclosure it was determined that applicant firstly did possess such subject matter, and secondly that said subject matter was described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. In that, it is noted that confusion arouse because applicant's initial "*labeling*" of the "*Comparative Example 2*" data, now amended "*Example 6*" was inaccurate. Furthermore, upon inspecting paragraphs 0022, 0026 and 0041 and Tables 1-2 as requested by the applicant, it was seen that applicant's invention did disclose the present invention including embodiments with pores of up to 20 μm ; and while the data of "*Comparative Example 2*" (15 μm), now amended "*Example 6*" does show capacity retention and discharge current density retention slightly less than the ones for original Examples 1-4 (5 μm) and Example 5 (5 μm), respectively, said data also shows superior capacity retention and discharge current density retention with respect to "*Comparative Example 1*" (30 μm). For that reason, the data presented by the applicant in the specification as filed has been found to be consistent with the general scope of the present application intending to specifically disclose and claim, inter alia, the effect of pore sizes in positive electrodes including an active sulfur.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

9. Claims 1-4, 8-17 and 38-39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chu 5523179 in view of the Japanese publication JP 47-028431 (herein called "*the JP'431 publication*").

The present claims are drawn to a lithium-sulfur battery wherein the disclosed inventive concept comprises the specific positive active material.

As to claims 1-3:

Chu discloses battery cells comprising a sulfur-based positive composite electrode wherein the active sulfur is elemental sulfur or sulfur containing discharge products of elemental sulfur; a negative electrode comprises lithium metal such as lithium metal or lithium-aluminum alloys (ABSTRACT/CLAIM 1/ CLAIM 9). It is disclosed that the positive electrode comprises

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an electronically conductive material and an ionically conductive material (COL 5, lines 1-9).

The electrolyte separator is also taught (CLAIM 1). It is disclosed that the electrolyte separator for solid state batteries functions as a separator for the positive and the negative electrodes, and as a transport medium for the metal ions (COL 11, lines 9-15). It is also disclosed that for battery cells containing a liquid electrolyte such battery format contains a separator within the liquid electrolyte (COL 11, lines 35-42). *Thus, the battery cell has a separator and an ion-conducting electrolyte.*

As to claims 4, 8, 10-14, and 16:

Chu teaches the use of elemental sulfur per se and conductive material (COL 4, lines 27-35/ COL 5, lines 1-15); it is disclosed that the term “active sulfur is defined to be elemental sulfur or sulfur that would be elemental if the positive electrode were in its theoretical fully charged state (COL 8, lines 32-35); it may also comprise binders (COL 5, lines 25-28). This composition is intermixed (COL 5, lines 1-8); it’s dispersed in a composite matrix by being mixed (COL 8, line 45 to COL 10, line 10). It is disclosed that the positive electrode slurry is cast directly onto a SS current collector (COL 10, lines 58-65).

Furthermore, as to the method limitation, i.e. i) mixing (ball mill), ii) coating, iii) removing, iv) injecting, v) employment of a plasticizer and its removing solvent and the likes, it is further noted that a method limitation incorporated into a product claim does not patentable distinguish the product because what is given patentably consideration is the product itself and not the manner in which the product was made. Therefore, the patentability of a product is independent of how it was made. In this regard, it is thus noted that since the plasticizer is removed from the positive electrode, the plasticizer and the removing solvent are not an active

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constituent of said positive electrode. That is, the plasticizer and the removing solvent were just employed as part of the preparation technique but the plasticizer was removed thereafter by using the solvent. Further, since the porosity of the positive electrode as claimed also includes "0 (zero) porosity" or "a pore-free material", it is hence asserted that no plasticizer and removing solvent is required.

As to claim 9:

Chu discloses the presence of polysulfide form material (COL 4, lines 30-36/ COL 4, lines 60-65).

As to claim 15:

Chu discloses the use of, at least, polyethylene oxide (COL 10, lines 46-55/ COL 9, lines 45-60/ COL 5, lines 9-15).

As to claim 17:

Chu discloses the ionic conductor in the positive electrode can be any of the solid-state or gel-state electrolytes described in the electrolyte separators and liquid electrolyte sections (COL 10, lines 23-27) as well as any electronically insulating and ionically conductive material which is electrochemically stable may be used (COL 10, lines 46-55/ COL 9, lines 45-60/ COL 5, lines 9-15). In particular, Chu teaches the following organic liquids of the battery cell incorporating the positive electrode: propylene carbonate; ethylene carbonate, N-methylpyrrolidinone, butyrolactone, tetramethylurea and the likes (COL 11, lines 26-35).

As to claims 38:

Chu teaches the employment of solid electrolytes (Col 11, lines 8-15/ COL 5, lines 62-67/ Col 10, lines 23-27).

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As to claim 39:

Chu teaches the use of polymeric, glass and/or ceramic materials are appropriate as solid-state electrolyte separators (Col 5, lines 62-67).

Chu et al disclose a lithium-sulfur battery comprising a sulfur-based positive composite electrode according to the foregoing aspects. However, Chu et al does not expressly disclose the specific pore size; and the pore size as recited in claim 3.

As to claims 1-3:

The JP'431 publication discloses a sodium-sulfur secondary battery with low voltage drop because of contact resistance wherein the battery comprises a cathode activator of a melted sulfur (ABSTRACT); the sulfur is an electric insulator so that it is necessary to increase conductivity of the sulphur to react electrochemically in the battery (ABSTRACT). It is disclosed that it is essential to use a porous conductor consisting of a material having a degree of porosity with pore diameters of 10-1000 μm as a cathode member to increase the conductivity of the cathode (ABSTRACT).

In view of the above, it would have been obvious to one skilled in the art at the time the invention was made to make Chu et al's positive active material including sulfur by having the specific pore size of the JP'431 publication because the JP'431 publication reveals that in battery system using sulfur it is essential to use a porous conductor consisting of a material having a degree of porosity with pore diameters of 10-1000 μm as a cathode member to increase the conductivity of the cathode, that is to say, to increase conductivity of the sulphur to react electrochemically in the battery. Thus, it is emphatically contended that the JP'431 publication discloses such cathodes having the specific pore size are better conductor and can be used in

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electrochemical applications involving alkali-metal technology. Therefore, since the prior art directly teaches a sulfur containing cathode having a pore diameter of at least 10-15 μm , a prima-facie case of obviousness still exists. Applicants' attention is respectfully directed to *MPEP 2144.05 [R-1] Obviousness of Ranges* where is stated that in the case where the claimed range lies inside or overlaps a range disclosed by the prior art a prima-facie case of obviousness exists. *In re Wertheim 191 USPQ 90*; or at least, is sufficient to establish a prima-facie case of obviousness. *In re Peterson 65 USPQ2d 1379*. Hence, the JP'431 publication directly teach the use of sulfur cathode materials having a pore size within the claimed range by positively stating that the pore diameter is critical to achieve the desired cathode conductivity. Furthermore, the JP'431 publication and Chu et al share the same field of endeavor as they both address and disclose alkali metal-sulfur based batteries and their related technologies.

As to the specific pore size as recited in claim 3, it would have been obvious to a skilled artisan at the time the invention was made to make Chu et al's positive active material by having the claimed pore size because even though the JP'431 publication does not overlap or lie inside the claimed pore diameter a prima facie case of obviousness exists where the claimed ranges and prior art ranges do not overlap but are close enough that one skilled in the art would have expected them to have the same properties. *Titanium Metal Corp. of America v. Banner 227 USPQ 773*. Moreover, the normal desire of scientists or artisans to improve upon what is already generally known provides the motivation to determine a satisfactory and optimum pore diameter. *The JP'431 publication discloses that the porosity and the pore size per se are essential to increase the conductivity of the cathode. Therefore, the specific porosity and pore size are taught to be a result-effective variable, and the discovery of optimum of result effective variable in a*

known process is ordinarily within the skill of art. In re Boesh 205 USPQ 215 (CCPA 1980).

Thus, applicant's arguments concerning this matter have been fully considered but are unpersuasive.

10. Claims 5-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chu 5523179 in view of the Japanese publication JP 47-028431 as applied to claim 4 above, and further in view of Kovalev et al 6652440.

Chu and the JP'431 publication are applied, argued and incorporated herein for the reasons above. However, the preceding prior art does not expressly disclose the specific particle size of the elemental sulfur.

Kovalev et al teach electroactive cathode materials for electrochemical cells (COL 1, lines 10-15) wherein the cathode materials comprise sulfur-sulfur bond such as elemental sulfur (COL 1, lines 43-50). It is disclosed that such cathode materials are useful in batteries employing alkali-metal anode, in particular, lithium or lithium-alloy anodes (COL 1, lines 35-53/COL 16, lines 64-67). It is further disclosed that in one embodiment, **the particle size of elemental sulfur is from 0.01 to 100 microns** (COL 5, lines 18-20/COL 12, lines 7-9). *It is noted that Kovalev et al's particle size range encompasses, at least, particle sizes up to 20 μm , or 10 μm or 5 μm .*

In light of these disclosures, it would have been obvious to one skilled in the art at the time the invention was made to use the specific particle size of the elemental sulfur of Kovalev et al in the lithium-sulfur battery of Chu-the JP'431 publication as Kovalev et al teach that elemental sulfur having the claimed particle size is useful for making positive electrode of lithium-sulfur batteries because this particular positive electrode material exhibits satisfactory

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specific capacity in combination with a lithium anode. As a consequence, lithium-sulfur batteries employing elemental sulfur having the claimed particle size as positive electrode achieves high energy capacity and rechargeability by the electrochemical cleavage via reduction and reformation via oxidation of the elemental sulfur. *Hence, Kovalev et al directly teach the use of elemental sulfur having a particle size within the claimed range. Therefore, since the prior art directly teaches that the particle size of elemental sulfur is from 0.01 to 100 microns, including at least from 0.01 μm up to 20 μm , a prima-facie case of obviousness still exists. Applicants' attention is respectfully directed to **MPEP 2144.05 [R-1] Obviousness of Ranges** where is stated that in the case where the claimed range lies inside or overlaps a range disclosed by the prior art a prima-facie case of obviousness exists. *In re Wertheim 191 USPQ 90*; or at least, is sufficient to establish a prima-facie case of obviousness. *In re Peterson 65 USPQ2d 1379*. Hence, Kovalev et al directly teach the use of sulfur materials having a particle size within the claimed range.*

Response to Arguments

11. Applicant's arguments filed 10/04/05 have been fully considered but they are not persuasive. Applicant's contention is substantially the same contention (arguments) previously put forth in the amendment of 04/06/05 and to which a response addressing such contention (arguments) was issued in the final rejection of 05/04/05. Thus, the examiner verily believes that most of applicant's arguments have been already properly addressed and responded to. Therefore, the response to applicant's arguments is being repeated here for applicant's convenience.

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12. (new response) By way of review, applicant is contending that “*there is no motivation to combine the references because ... Chu present different solutions to the same conductivity problem... Chu would not suggest looking to the specific porosity*” and that “the JP’431 teaches using melted sulfur (infusing)” and that “*the broad range of pore sizes disclosed in JP’431 does not overlap...*”. In response to applicant's argument that the two references are not combinable, the fact that applicant has recognized another advantage/disadvantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985). In addition to that, the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. (**←Emphasis added**) See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981). Moreover, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). Lastly, applicant is reminded that a showing of unexpected results should include a direct comparison between the claimed invention and the closest prior art. To that effect, applicant has not demonstrated that unexpected results are obtainable over the combined-art. Burden is on applicant to furnish objective evidence demonstrating so.

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Accordingly, a strong prima-facie case of obviousness is deemed to still exist as the combined prior art (i.e. Chu and JP'431) directly teach all the claimed features, particularly, the instantly claimed invention including pore size within the claimed range. Thus, it is believed that the prima-facie case of obviousness is strong enough.

13. (*new response*) Applicant's arguments concerning the abovementioned new matter issue has been considered but they are not convincing as applicant has neither demonstrated nor provided evidence as to how it was arrived at the specific range of "greater than substantially 5 μm and is less than 10 μm " (which is mathematically equivalent to $5 \mu\text{m} < \text{pore size} < 10 \mu\text{m}$). Applicant's disclosure only supports main base values such as specifically "up to 20 μm ; Preferably, the average size is up to 10 μm , and more preferably up to 5 μm ". Other than that, there is no existence in the specification as filed of other specific magnitudes (e.g. 6 μm , 7 μm , 8 μm , 9 μm , 11 μm , 12 μm and so on) investigated or studied by the applicants to evidently support applicant's position that such magnitudes of "less than 10 μm , not inclusive" were or are originally intended by the current disclosure. Therefore, other than attempting to overcome the prior art of record disclosing a pore size of "at least 10 μm ", it is not clear how applicant has arrived at the specific now claimed magnitude. Yet further, the position taken by the applicant that "the bounds of the amended range needs to be at least mathematically between the more broadly disclosed bounded range since all amounts within the broad bounded range are necessarily disclosed" is not convincing in this instance because of the foregoing.

14. (*new response*) With respect to the 35 USC 112 regarding the scope of enablement (*item 4 in the final action dated 05/04/05*), applicant's arguments and amendments to the specification has been carefully considered and they have satisfactorily resolved the scope of enablement

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issue. Indeed, after examining applicant's original disclosure it was determined that applicant firstly did possess such subject matter, and secondly that said subject matter was described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. In that, it is noted that confusion arose because applicant's initial "*labeling*" of the "*Comparative Example 2*" data, now amended "*Example 6*" was inaccurate. Furthermore, upon inspecting paragraphs 0022, 0026 and 0041 and Tables 1-2 as requested by the applicant, it was seen that applicant's invention did disclose the present invention including embodiments with pores of up to 20 μm ; and while the data of "*Comparative Example 2*" (15 μm), now amended "*Example 6*" does show capacity retention and discharge current density retention slightly less than the ones for original Examples 1-4 (5 μm) and Example 5 (5 μm), respectively, said data also shows superior capacity retention and discharge current density retention with respect to "*Comparative Example 1*" (30 μm). For that reason, the data presented by the applicant in the specification as filed has been found to be consistent with the general scope of the present application intending to specifically disclose and claim, inter alia, the effect of pore sizes in positive electrodes including an active sulfur.

The following response to arguments was asserted in the final rejection of 05/04/05, and is again presented herein (as explained hereinbefore) to further address applicant's current arguments.

15. The principal contention of applicants' arguments is now premised on the assertion that "a prima-facie case of obvious does not exist simply because the JP'341 publication describes a solution to a problem already solved in Chu in regards to sulfur conductivity and does not

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suggest that the solution is advantageous over the solution proposed in Chu” (i.e. “*Chu already suggests a solution to the very problem which JP’431 purports to solve*”). However, this assertion is still insufficient to overcome the 35 USC 103 obviousness rejection because the test for obviousness is not whether the features of a secondary reference may be bodily (i.e. functionally) incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art (*emphasis added*). See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981). Moreover, the fact that applicant has recognized another advantage/disadvantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985). Moreover, not because the two references solve the conductivity issue in apparent dissimilar ways, the specific teaching of the pore size of the JP’341 publication becomes irrelevant to the general teachings of Chu. Therefore, the applied obviousness rejection will be maintained unless applicants provide objective evidence demonstrating that the JP’341 publication’s material including the claimed pore size cause deleterious or catastrophic effects if used in the lithium-sulfur battery of Chu. The burden is shifted to the applicants.

16. With respect to applicants’ arguments that “there is no expectation as to which element of this large range would achieve best conductivity, nor an invitation to explore pore diameters below 10 μm or above 1000 μm (i.e. in reference to the teachings of the JP’431)”, the examiner contests that given that the JP’431 publication directly teaches a sulfur containing cathode having a pore diameter of at least 10-15 μm , a prima-facie case of obviousness still exists.

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Applicants' attention is respectfully directed to **MPEP 2144.05 [R-1] Obviousness of Ranges** where is stated that in the case where the claimed range lies inside or overlaps a range disclosed by the prior art a prima-facie case of obviousness exists. In re Wertheim 191 USPQ 90; or at least, is sufficient to establish a prima-facie case of obviousness. In re Peterson 65 USPQ2d 1379. Hence, the JP'431 publication directly teaches using sulfur cathode materials having a pore size within the claimed range by positively stating that the pore diameter is critical to achieve the desired cathode conductivity. Moreover, having presented reasonable ground of rejection based on the teachings of such Japanese publication (i.e. the JP'431 publication), it is contended that the JP'431 publication discloses that it is essential to use a porous conductor [in sulfur containing cathodes and batteries] consisting of a material having a degree of porosity with pore diameters of 10-1000 μm as a cathode member to increase the conductivity of the cathode. As a result, the examiner has presented reasonable and justifiable evidence to maintain that that the prior art certainly imparts criticality to the pore diameter.

17. As to the assertion that "Kovalev et al suggest multiple particle sizes for elemental sulfur, including particles from 0.01 to 100 microns, but Kovalev et al does not suggest which particle size should be used within this broad range, or which portion is advantageous to use", the examiner again contests that given that Kovalev et al directly teaches that the particle size of elemental sulfur is from 0.01 to 100 microns, including at least from 0.01 μm up to 20 μm , a prima-facie case of obviousness still exists. Applicants' attention is respectfully directed to **MPEP 2144.05 [R-1] Obviousness of Ranges** where is stated that in the case where the claimed range lies inside or overlaps a range disclosed by the prior art a prima-facie case of obviousness exists. In re Wertheim 191 USPQ 90; or at least, is sufficient to establish a prima-facie case of

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obviousness. In re Peterson 65 USPQ2d 1379. Hence, Kovalev et al directly teach the use of sulfur materials having a particle size within the claimed range.

18. As to the specific pore size as recited in claim 3, it is stated that a prima facie case of obviousness exists where the claimed ranges and prior art ranges do not overlap but are close enough that one skilled in the art would have expected them to have the same properties.

Titanium Metal Corp. of America v. Banner 227 USPQ 773. Moreover, the normal desire of scientists or artisans to improve upon what is already generally known provides the motivation to determine a satisfactory and optimum pore diameter. The JP'431 publication discloses that the porosity and the pore size per se are essential to increase the conductivity of the cathode.

Therefore, the specific porosity and pore size are taught to be a result-effective variable, and the discovery of optimum of result effective variable in a known process is ordinarily within the skill of art. In re Boesh 205 USPQ 215 (CCPA 1980). Thus, applicant's arguments concerning this matter have been fully considered but are unpersuasive.

19. With particular respect to applicants' arguments regarding the broad range (including both the pore diameter range and/or the broad particle size range of Kovalev et al), the examiner now categorically contends that the JP'431 publication positively discloses such cathodes having the specific pore size are better conductor (conductivity is increased) and can be used in electrochemical applications involving alkali-metal technology; in addition, it is also stated that Kovalev et al directly teach the use of elemental sulfur within the claimed particle size. Hence, since the prior art of record directly teaches a sulfur containing cathode having a pore diameter of at least 10-15 μm (*regardless the entire disclosed range from 10-1000 μm*) and elemental sulfur having a particle size ranging from 0.01-100 μm , a prima-facie case of obviousness still

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exists. Applicants' attention (**emphasis added**) is respectfully directed to *MPEP 2144.05 [R-1]*

Obviousness of Ranges where is stated that in the case where the claimed range lies inside or

overlaps a range disclosed by the prior art a prima-facie case of obviousness exists. *In re*

Wertheim 191 USPQ 90; or at least, is sufficient to establish a prima-facie case of obviousness.

In re Peterson 65 USPQ2d 1379. In particular, the JP'431 publication directly disclose the use of sulfur cathode materials having a pore size within the claimed range by positively stating that the pore diameter is critical to achieve the desired cathode conductivity; and Kovalev et al's particle size range encompasses the claimed one.

20. In the event that applicants further argue that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, the JP'431 publication and Chu et al share the same field of endeavor and/or at least are pertinent to the particular problem with which the applicant was concerned as they both address and disclose alkali metal-sulfur based batteries and their related technologies.

21. As to the assertion that the prior art "does not suggest advantage to any of these ranges as evident from Figures 4 and 5 and Tables 1 and 2 and paragraph 0023 and 0024" and that "applicant's range imparts a novel feature as compared to the general conditions suggested in the existing art", it is noted that applicants' results show that the particular range is critical for a particle size of 5 μ m only. For example, EXAMPLES 1-4 show the use of particle sizes of 5 μ m

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only (SEE EXAMPLES 1-4). Further, Applicants are also comparing EXAMPLES 1-4 having a particle size of 5 μm with COMPARATIVE EXAMPLES 1-2 having particle sizes of 30 μm and 15 μm , respectively. Thus, as apparently admitted by the applicants, there is no unexpected result for the claimed range of particle sizes greater than about 15 μm . In addition, the results of Tables 1-2 of which applicants claim to show unexpected results are only commensurate with the specific particle size of 5 μm . Hence, applicants have failed to provide objective evidence establishing the advantage of particle sizes throughout the entire claimed range (i.e. greater than or equal to 5 and less than and including 15 μm). Thus, it is considered that particle sizes immediately below about 5 μm and greater than 5 μm (i.e. $0 < \text{particle size } (\mu\text{m}) < 5$ and $5 < \text{particle size } (\mu\text{m}) \leq 15$) has no effect on the life cycle of the resulting battery. Therefore, since the prior art directly teaches particle sizes greater than 5 μm , a prima-facie case of obviousness still exists. Applicants' attention is respectfully directed to **MPEP 2144.05 [R-1] Obviousness of Ranges** where is stated that in the case where the claimed range lie inside a range disclosed by the prior art a prima-facie case of obviousness exists. In re Wertheim 191 USPQ 90; or at least, is sufficient to establish a prima-facie case of obviousness. In re Peterson 65 USPQ2d 1379.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Raymond Alejandro whose telephone number is (571) 272-1282. The examiner can normally be reached on Monday-Thursday (8:00 am - 6:30 pm).

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick J. Ryan can be reached on (571) 272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Raymond Alejandro
Primary Examiner
Art Unit 1745


RAYMOND ALEJANDRO
PRIMARY EXAMINER